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NEW OBSERVATIONS ON THE ABERRANT MEDUSA *TETRAPLATIA VOLITANS* BUSCH

by

William J. Rees and Ernest White
British Museum (Natural History)

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(Figs. 1–7)

INTRODUCTION

THE published records of the occurrence of the aberrant medusa *Tetraplatia volitans* Busch indicate that it probably has a cosmopolitan distribution, for it has been found sporadically in all oceans. Until now, however, there were no records of its occurrence in the North Atlantic, except south of Gibraltar and in the Mediterranean. Additional material has come to light which extends its known range northwards along the edge of the continental shelf off the western seaboard of the British Isles. Farther afield too, there are new records of distribution.

Recently and independently, two papers have been published on the occurrence of this medusa in different parts of the world (Beyer, 1955; Hand, 1955), which to some extent present diverging views on the biology of the species. The object of this paper is, therefore, to draw attention to the fact that this species may be found during deep-sea investigations to the south and west of the British Isles, and to draw some conclusions regarding the biology of the species from the additional data.

ACKNOWLEDGEMENTS

We wish to thank Dr N. A. Mackintosh, C.B.E., Dr Helene Bargmann and Mr A. de C. Baker of the National Institute of Oceanography for material in the Discovery collections, and Dr J. H. Fraser, Scottish Home Department, Aberdeen, for a specimen from plankton collected by F.R.V. 'Explorer'.

NEW RECORDS OF *TETRAPLATIA*

The following records of *Tetraplatia* are based on material taken by Dr G. H. Fowler's cruise to the Bay of Biscay in H.M.S. 'Research' in 1900, by R.R.S. 'Discovery II', by 'Carnegie VII' and by 'Explorer'.

The records without an asterisk are new, those denoted by an asterisk have been briefly mentioned by Beyer (1955) and those denoted by an obelus are known only as records in the plankton analysis sheets of the Discovery Investigations.

List of Stations at which *Tetraplatia* was taken:

H.M.S. 'Research', July 1900. Approx. 47° N., 7° W., Bay of Biscay

St. 32*o*, 75–0 fm., 2 specimens.
St. 33*d*, 100–0 fm., 1 specimen.
St. 35*b*, 100–0 fm., 1 specimen.

R.R.S. 'Discovery II'

St. 670, 44° 52′ S., 30° 17′ W., South Atlantic, 23. iv. 31, TYFB, 470–0 m. 1 specimen.
St. 943, 45° 28·4′ S., 179° 06·4′ E., South Pacific, S.E. of New Zealand, 1. ix. 32, N 70 V, 500–250 m., 1 specimen.
*St. 1773, 39° 07′ S., 00° 15·5′ E.–39° 04′ S., 00° 12·5′ E., South Atlantic, 24. v. 36, N 70 V, 750–500 m., 1 specimen.

*St. 1775, 44° 40·3′ S., 00° 33·5′ E.–44° 40′ S., 00° 37′ E., South Atlantic, 27. v. 36, N 70 V, 750–500 m., 2 specimens.
*†St. 1778, 52° 14·7′ S., 00° 1′ W.–52° 12·8′ S., 00° 07′ E., South Atlantic, 30. v. 36, N 70 V, 1500–1000 m.
St. 1913, 53° 55·2′ S., 56° 45·7′ W., South Atlantic, Patagonian Shelf, 1. xii. 36, N 70 B, 250–160 m., 1 specimen.
*St. 2024, 45° 01·3′ S., 00° 33·7′ E., South Atlantic, 30. iii. 37, N 70 V, 500–250 m., 1 specimen.
*†St. 2356, 42° 56·8′ S., 00° 21·2′ E., South Atlantic, 7. vii. 38, N 70 V, 750–500 m., 1 specimen.
*St. 2386, 44° 04·9′ S., 00° 15·4′ E., South Atlantic, 12. viii. 38, N 70 V, 750–500 m., 1 specimen.
*St. 2496, 50° 20·7′ S., 01° 03·3′ E., South Atlantic, 2. xii. 38, N 70 V, 1000–750 m., 1 specimen.
St. 2582, 39° 53·9′ S., 00° 39·1′ E., South Atlantic, 20. ii. 39, N 100 B, 1050–750 m., 2 specimens.
St. 2641, 00° 45·3′ S., 07° 26·6′ W., Equatorial Atlantic, off W. Africa, 16. iv. 39, N 50 V, 100–0 m., 1 specimen.
St. 3230, 47° 30′ N., 07° 35′ W., Bay of Biscay, 14. v. 55, N 70 V, 500–250 m., 2 specimens, N 70 V, 750–500 m., 1 specimen.
St. 3233, 46° 02′ N., 09° 19′ W., Bay of Biscay, 15. v. 55, N 70 V, 250–100 m., 4 specimens, 500–0 m., 1 specimen.
St. 3234, 43° 13′ N., 12° 04′ W., W. of Cape Finisterre, 17. v. 55, N 70 V, 500–250 m., 2 specimens, N 70 V, 750–500 m., 2 specimens, N 70 V, 1000–0 m., 6 specimens.
St. 3272, 45° 51′ N., 08° 43′ W., Bay of Biscay, 27. vi. 55, TYFB, 1000–0 m., 8 specimens.
St. 3273, 46° 27′ N., 08° 04′ W., Bay of Biscay, 27. vi. 55, N 70 V, 500–250 m., 3 specimens, 750–500 m., 1 specimen.

'Carnegie VII'

St. 49/50, 26° 27′ S., 115° 21′ W., E. South Pacific, 28. xi. 28, surface, 2 specimens.
St. 93, 14° 41′ S., 167° 41′ W., South Pacific, between Tahiti and Samoa, 31. iii. 29, surface, 6 specimens.

F.R.V. 'Explorer'

St. E 52/1305, 58° 38′ N., 8° 21′ W., N.W. of Scotland, 24. vi. 52, 500–0 m., 1 specimen.

GEOGRAPHICAL DISTRIBUTION

Earlier records of *Tetraplatia* indicated that it had a world-wide distribution although there were large areas, especially in the Indian Ocean, the North Atlantic and in the Central and South Pacific, where it had not been found. Dantan (1925) gives excellent figures of this species.

The new records of geographical distribution are given in the list of specimens. No new records are available for the Indian Ocean.

Formerly, *Tetraplatia* was not known farther north in the Atlantic Ocean than about the latitude of Gibraltar; now there are several new records of it. In 1900 H.M.S. 'Research' took it at three stations in the Bay of Biscay‡; recently 'Discovery II' took it in 1955 at a neighbouring station, as well as at four other positions to the south-west (Fig. 1). The most northerly recorded position for the species is that of 'Explorer' (58° 38′ N., 8° 21′ W.); these records from the North Atlantic suggest that *Tetraplatia* occurs in deep water along the west coasts of the British Isles.

Farther south, 'Discovery II' captured the species off the equatorial West African region (St. 2641), at a series of stations (Sts. 1773, 1775, 1778, 2024, 2356, 2386, 2496, 2582) all approximately along the 0° line, between 38° S. and 52° S. in the South Atlantic, and at two other localities to the west (Sts. 670 and 1913) (Fig. 2).

Three interesting records come from the Pacific. Previously *Tetraplatia* was only known from off Japan (Komai, 1939), off the Californian coast, off equatorial South America (Hand, 1955) and off Chile (Beyer, 1955), but the new localities from the South Pacific ('Carnegie' St. 49/50 and St. 93 and 'Discovery II' St. 943) indicate that the species must have a wide distribution throughout the greater part of the Pacific (Fig. 2). Consideration of all the records now available implies that the species may occur in all oceans between 52° S. and 58° N.

‡ For details of stations, see Browne (1906).

So far there are no records either from the Arctic or from the Red Sea. It would be interesting to know whether *Tetraplatia* penetrates into the Arctic basin and also whether it can tolerate the high salinity of the Red Sea.

Fig. 1. The distribution of *Tetraplatia volitans* in the North Atlantic. H.M.S. 'Research': open circle with a central dot; R.R.S. 'Discovery II': black circles in Atlantic; F.R.V. 'Explorer': half circle filled-in; previous records in the Mediterranean: black circles.

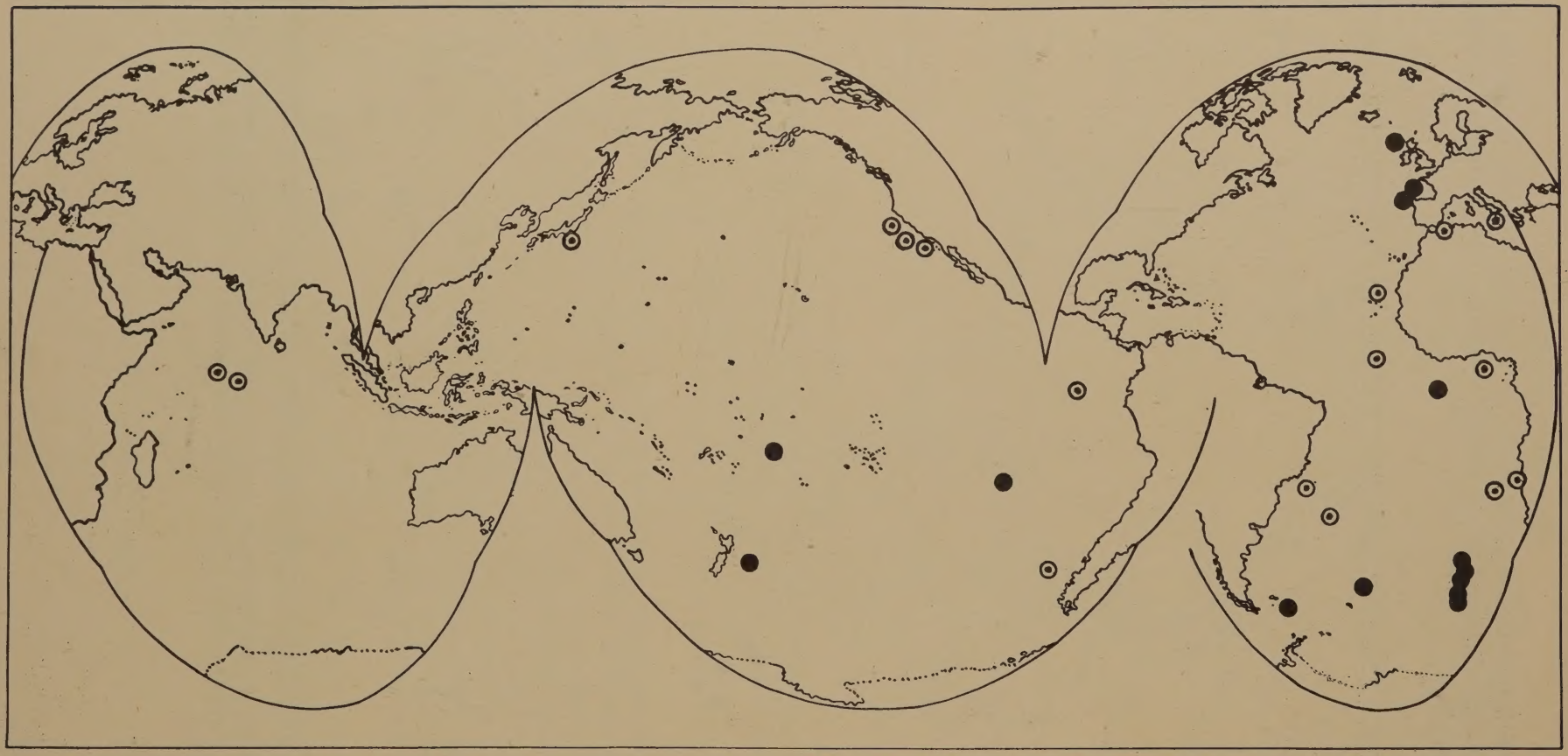

Fig. 2. World-wide distribution of *Tetraplatia volitans*. Previous records: open circles; new records: black circles.

VERTICAL DISTRIBUTION

It is well known that *Tetraplatia volitans* can occur in surface waters in the Mediterranean (Busch, 1851) and elsewhere (Komai, 1939; Hand, 1955). The most recent authors to present some details of vertical distribution have been Hand (1955) and Beyer (1955). From a study of horizontal closing-net hauls taken off the Californian coast, Hand concluded that *Tetraplatia* undergoes vertical migration with centres of population at about 40 m. by night and at about 250 m. or more by day. Hand further concluded from separate open-net hauls that 'in general, the deeper the tow the more specimens were captured'. Concerning this type of fishing (done by the earlier expeditions), we are in agreement with his views that 'little but speculative results can be gleaned from them and no exact information is available on the lower limits of the vertical distribution of *Tetraplatia*'.

Beyer (1955) reported two specimens from the 'Brategg' Expedition in a vertical haul from 1000–550 m.,* this being the first indication that *Tetraplatia* was to be found below 550 m. In an appendix he mentioned briefly other specimens from the closing-net hauls of the Discovery collections. These, together with many additional records (which have subsequently come to light), are discussed here.

The following table (Table 1) summarizes the data on nets, fishing-depth and soundings for catches of *Tetraplatia* in the closing-net hauls of the Discovery collections.

Table 1. *Summary of data on type of net, fishing-depth and sounding*

Expedition	*Station*	*Type of net*	*Fishing-depth* (m.)	*Sounding* (m.)
H.M.S. 'Research'	32*o*	?	75–0	Over 3657
	33*d*	?	100–0	
	35*b*	?	100–0	
R.R.S. 'Discovery II'	670	TYFB	470–0	—
	943	N 70 V	500–250	2552
	1773	N 70 V	750–500	5202
	1775	N 70 V	750–500	4166
	1778	N 70 V	1500–1000	3000
	1913	N 70 B	250–160	1628
	2024	N 70 V	500–250	4495
	2356	N 70 V	750–500	1980
	2386	N 70 V	750–500	4089
	2496	N 70 V	1000–750	3482
	2582	N 100 B	1050–750	3897
	2641	N 50 V	100–0	4885
	3230	N 70 V	500–250	1420–1110
		N 70 V	750–500	
	3233	N 70 V	250–100	4817
	3234	N 70 V	500–250	2513
		N 70 V	750–500	
		N 70 V	1000–0	
	3272	TYFB	1000–0	4848
	3273	N 70 V	500–250	4707
		N 70 V	750–500	

This table serves to emphasize that *Tetraplatia* is a pelagic animal frequently occurring far from land and is to be found over very deep water. These results are summarized in Table 2 for the closing-net hauls of 'Discovery II'.

Only a very small percentage of the Discovery collections have been examined for *Tetraplatia*, so that we do not propose to discuss the relative numbers of specimens caught at different depths; what does emerge, however, is that *Tetraplatia* has been taken at all levels from the surface down to the

* Presumably a closing-net.

1000–1500 m. level. When the results are plotted on a chart, many of the records are seen to be from localities where vertical displacement of water masses is likely to take place.

Table 2. *Vertical distribution of the specimens from the closing-net hauls of* R.R.S. 'Discovery II'

Depth in metres	*Number of specimens*
0–100	8
100–250	5
250–500	8
500–750	8
750–1000	4
1000–1500	1
1500–2000	—

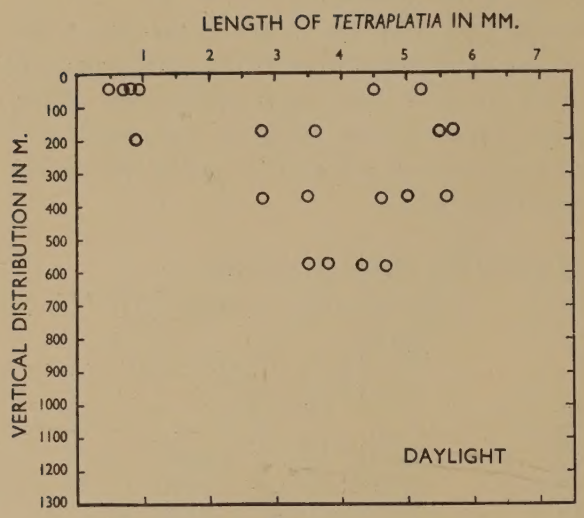
LENGTH OF TETRAPLATIA IN MM.
1 2 3 4 5 6 7
VERTICAL DISTRIBUTION IN M.
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300
DAYLIGHT

Fig. 3

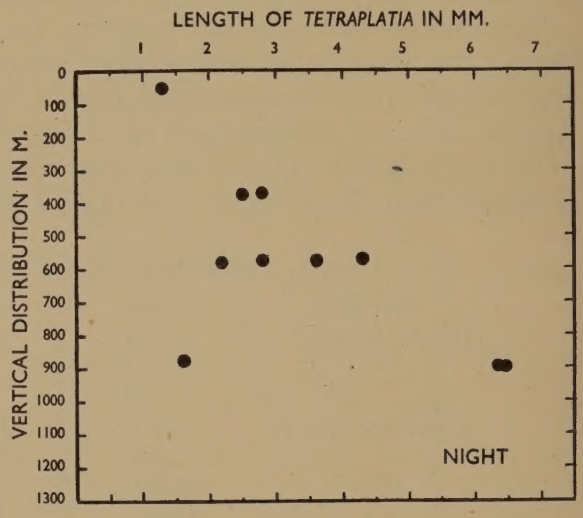

Fig. 4

Figs. 3–4. Vertical distribution of *Tetraplatia volitans*. All records below 100 m. are from the closing-net hauls of R.R.S. 'Discovery II': fig. 3, by day; fig. 4, by night.

The catches of the closing-net hauls have been plotted in Figs. 3 and 4 for any indication of diurnal vertical migration, but it must be remembered that the catches are from different parts of the world and the marked migration reported by Hand from California is perhaps masked by different local conditions. By day *Tetraplatia* was found at the surface down to 500–750 m. with a slight preponderance of young stages in the upper 100 m. At 100–250 m. specimens of 0·9–5·4 mm. in length were found, but below this depth, between 250 and 500 m., only individuals of 2·6–5·7 mm. occurred, and still deeper, at 500–750 m., specimens of 3·5–4·7 mm. were taken. There is no positive indication here (perhaps, as already mentioned, because of the varied localities at which captures were made) that *Tetraplatia* tends to go deeper by day.

Its vertical distribution by night is indicated in Fig. 4. Except for a small specimen (1·6 mm. in length) from St. 2496 (1000–750 m.), there is a suggestion that the larger specimens are to be found at the deeper levels.

SEASONAL OCCURRENCE

In the Mediterranean, *Tetraplatia volitans* was recorded only seasonally by the early investigators. It was found from December to April at Algiers by Viguier (1885) and from January to the end of July at Messina (Carlgren, 1909), and this seasonal appearance is probably due to local changes in hydrographic conditions. In the Bay of Algiers the appearance of *Tetraplatia* in winter is probably related

to the direction of the prevailing winds, which, at this season, blow offshore, displacing surface water and probably causing an upwelling of deeper water.

Elsewhere *Tetraplatia* has been taken in all seasons except in January (Hand, 1955) and 'Discovery II' has taken it all the year round except in January and October.

So long as *Tetraplatia* appeared to be of seasonal occurrence in the plankton, it was thought to have a fixed benthic stage, but since records from several open ocean stations were reported by Leloup (1935), it has been rightly considered to be wholly pelagic. There is a suggestion, as in other wholly planktonic animals, that the young stages of *Tetraplatia* are found in the upper surface layers. 'Carnegie' took six specimens 0·5–0·8 mm. in length in a surface haul at St. 93, and at St. 33*d* H.M.S. 'Research' took a specimen of 0·9 mm. in the upper 100 m. Another specimen of the same size was taken at 'Discovery II' St. 1913 (250–160 m.), but below this depth no specimen under 1·0 mm. in length was taken in any of the hauls.

HYDROGRAPHIC CORRELATIONS

Fortunately hydrographic observations were made at most of the stations where closing-nets were operated and these are summarized in Table 3. The data are plotted on temperature-salinity charts, similar to those recommended by Pickford (1946) for the analysis of hydrographic correlations (Figs. 5–7).

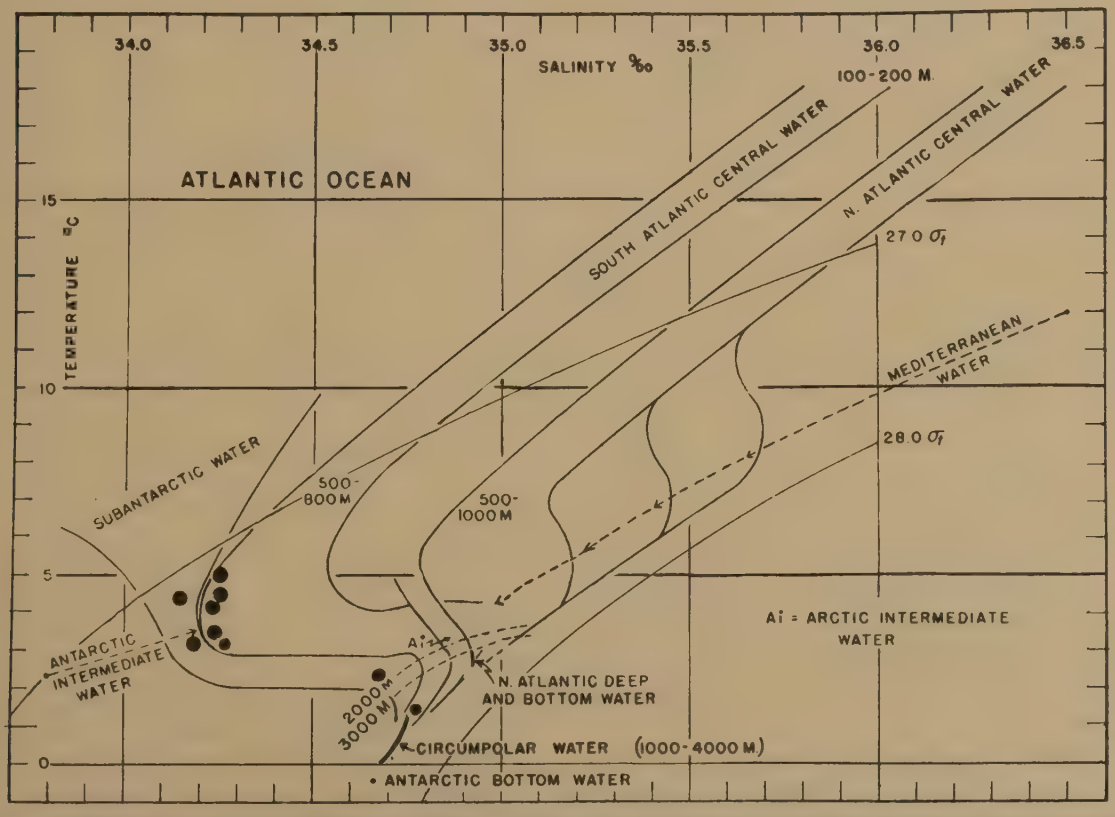

Fig. 5. Distribution of *Tetraplatia volitans* in relation to temperature and salinity in the South Atlantic. Each specimen is plotted according to the recorded salinity and temperature for the depth nearest to the mid-depth of the closing-net at that station. No records of *Tetraplatia* have been used unless temperature and salinity reading have been available for that particular station.

Table 3. *Summary of hydrographic data for closing-net stations only*

'Discovery II' Station	Depth of capture (m.)	Hydrographic data: Depth (m.)	Temperature (° C.)	Salinity (‰)	Density (σ_t)
943	500–250	400	6·08	34·34	27·05
1773	750–500	570	4·50	34·23	27·15
1775	750–500	570	3·56	34·22	27·22
1778	1500–1000	1470	1·39	34·77	27·85
1913	250–160	200	4·34	34·14	27·09
2024	500–250	400	3·35	34·21	27·25
2356	750–500	580	5·07	34·26	27·10
2386	750–500	600	3·15	34·18	27·24
2496	1000–750	930	2·23	34·69	27·72
2582	1050–750	920	3·05	34·27	27·32
2641	100–0	50	22·77	36·08	24·83

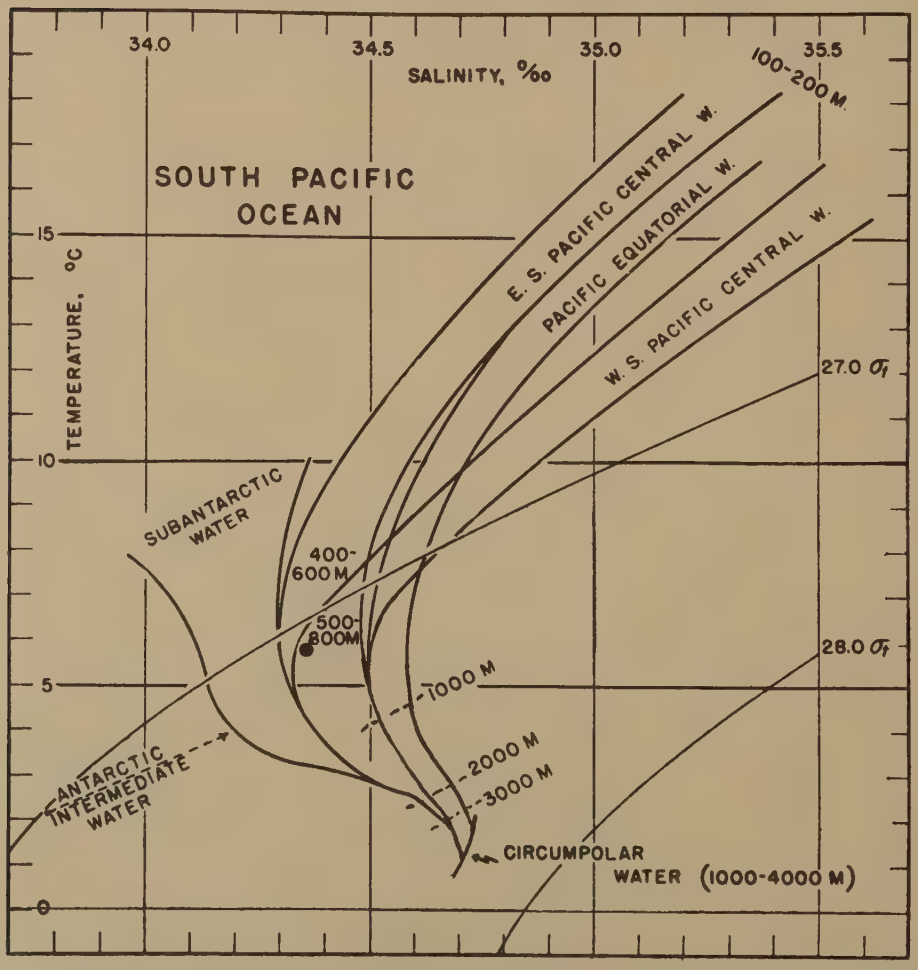

Fig. 6. Distribution of *Tetraplatia volitans* in relation to temperature and salinity in the South Pacific. Details as for Fig. 5.

Detailed hydrographic observations were not made at the North Atlantic stations; those for the South Atlantic are plotted on Fig. 5. Here *Tetraplatia* is an inhabitant of Sub-Antarctic water and of the South Atlantic Central water at temperatures between 1·39° C. and 5·07° C. However, at St. 2641 in the Equatorial Atlantic, *Tetraplatia* was taken in a haul from 100 m. to the surface, where the temperature at 50 m. was 22·77° C. The species must therefore be considered eurythermal.

Hydrographic data are available for only one catch from the Pacific (Fig. 6). This was St. 943 to the south-east of New Zealand where the species was found in W. S. Pacific Central Water.

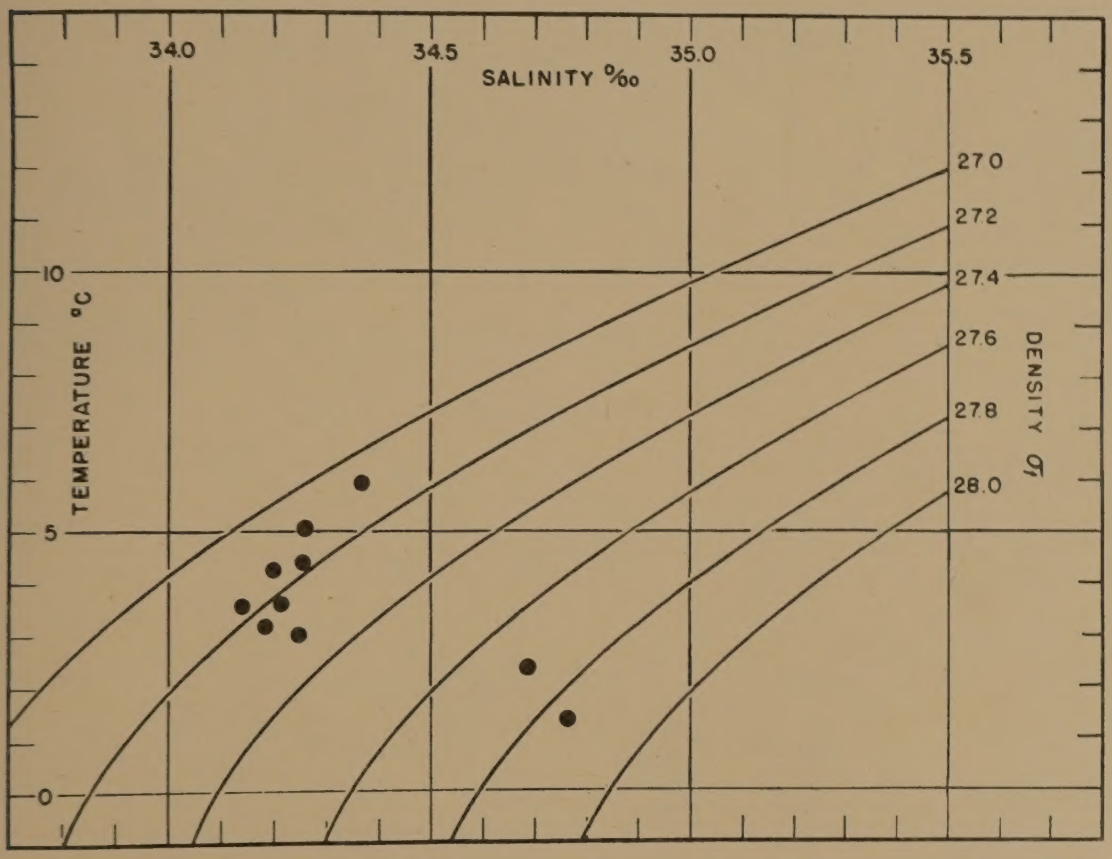

Fig. 7. Distribution of *Tetraplatia volitans* in relation to density layers. Each point represents the probable temperature and salinity at depth of capture as in Fig. 5.

In the South Atlantic, *Tetraplatia* has been found in salinities of 34·14‰–34·77‰ and at St. 2641 on the equator where the salinity at 50 m. depth was 36·08‰. *Tetraplatia* must thus be regarded as a euryhaline species.

The distribution of *Tetraplatia volitans* in relation to salinity, temperature and density is plotted in Fig. 7.*

To conclude, therefore, *Tetraplatia* can exist in temperatures of 1·39° C.–22·77° C., salinities of 34·14‰–36·08‰ and densities of between (σ_t) 24·83 and 27·85, so that the species can be regarded

* St. 2641 from the Equatorial Atlantic where the temperature was 22·77° C., the salinity 36·08‰ and the density 24·83 at 50 m. depth cannot be plotted on this chart. At 100 m. depth the temperature was 16·85° C.; the salinity 35·72‰ and the density 26·12.

as tolerant of a wide range of conditions. As a bathypelagic planktonic animal *Tetraplatia* could achieve world-wide dispersal through the slow circulation of the water masses in the way envisaged by Coe (1946) for the bathypelagic nemerteans.

SUMMARY

This study of *Tetraplatia volitans* Busch is based on fifty-five specimens from various localities taken by H.M.S. 'Research' (1900), the Discovery collections (1931–54) and the cruises of 'Carnegie VII' and 'Explorer'.

Tetraplatia is recorded for the first time, from the north-east Atlantic in the neighbourhood of the British Isles, from several new localities in the South Atlantic and from three new areas in the South Pacific.

The closing-net hauls of 'Discovery II' show that *Tetraplatia* occurs at all levels from the surface downwards to 1000–1500 m. There is no positive indication of any marked diurnal migration, possibly because of varying local conditions where the specimens were taken, but there is a suggestion that the younger stages are to be found in the upper surface layers. This is in agreement with the conclusions of Leloup (1935) and of Hand (1955) that *Tetraplatia* is wholly pelagic without a bottom benthic phase.

Tetraplatia volitans is found to be a eurythermic, euryhaline pelagic species tolerant of a wide range of conditions.

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